

ISS-MPLM-PLAN-019

[Basic]

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**MSFC**

**Safety & Mission Assurance**

**Plan**

**for**

**International Space Station**

**Multi-Purpose Logistics Module  
(MPLM)**

**Sustaining Engineering**

## APPROVAL SHEET

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## ACRONYMS

The following acronyms apply:

DR1/2	Design Review 1 or 2
CEI	Cargo Element Integration
CIL	Critical Items List
FCA	Functional Configuration Audit
FMEA	Failure Modes and Effects Analysis
FRR	Flight Readiness Review
ISS	International Space Station
JSC	Johnson Space Center
LLIL	Limited Life Items List
LOD	Letter of Delegation
MRR	Mission Readiness Review
MSFC	Marshall Space Flight Center
NPG	NASA Procedures and Guidelines
PCA	Physical Configuration Audit
PRA	Probability Risk Assessment
PDR	Preliminary Design Review
PMA	Pressurized Mating Adapter
PRACA	Problem Reporting and Corrective Action
QA	Quality Assurance
R&M	Reliability and Maintainability
RID	Review Item Discrepancy
S&MA	Safety and Mission Assurance
SMAP	Safety and Mission Assurance Plan
SMART	Safety and Mission Assurance Review Team
SRR	Software Requirements Review
SSPP	System Safety Program Plan
TIM	Technical Interchange Meeting

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## 1.0 GENERAL

### 1.1 Introduction

The MPLM is a pressurized carrier, developed by Alenia Spazio under contract to the European Space Agency, that supports ISS logistics by providing capability for cargo supply and return, internal to a pressurized module. The MPLM is composed of a cylindrical shell terminated on one end by a forward cone that includes a hatch and berthing mechanism to allow on-orbit transfer of cargo, and on the other end, by a large access cover for cargo installation and removal on the ground. The MPLM is transported in the Shuttle Payload Bay in either an active or passive configuration. These configurations refer to whether or not utilities are provided to the payloads manifested on the MPLM. Power and commanding is available to MPLM Systems in the payload bay for provision of shell heaters to prevent condensation in the module and operation of internal fans to assure proper mixing of the MPLM atmosphere.

The racks and RSP stowage bags are transferred between the MPLM and the ISS. The Boeing Prime Hazard Analysis will address the hazards that could occur during rack and stowage transfer. The MPLM is detached from the ISS and secured in the Orbiter PLB. The hazards associated with the MPLM transfer to and from the ISS are addressed by the Boeing Prime Hazard Analysis. The Orbiter undocks, de-orbits, and lands.

This document presents the Marshall Space Flight Center (MSFC) Safety and Mission Assurance (S&MA) Plan (SMAP) for the Sustaining Engineering portion of the MPLM Project.

### 1.2 Objectives

S&MA will, through oversight, ensure that appropriate risk management, quality assurance, reliability, maintainability, and system safety activities are implemented during the

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Sustaining Engineering portion of the MPLM Project per the statement of work as defined in this document.

The MSFC S&MA activity is to ensure compliance with the:

?? MPLM Project Plan, MSFC-PLAN-3064

?? SSP41183.OSS Quality Assurance Requirements

### 1.3 Customer Definition and Advocacy

The customers are the MSFC MPLM Project Manager, Associate Administrators for Codes Q and M, and the International Space Station program. This plan will identify the planning and implementation necessary to satisfy program requirements defined by these customers.

### 1.4 Agreement

The responsibility for determining how the program will be implemented and the accountability for meeting program milestones resides with the MSFC Project Manager.

MSFC was the lead NASA Center, responsible for cost, schedule, and technical performance for the development of the MPLM end items, and is currently the Element Manager supporting MPLM Sustaining Engineering functions. JSC is responsible for integration of MPLM into the ISS.

### 1.5 MSFC S&MA Authority

The MSFC S&MA Office is responsible for all safety and mission assurance activities for the MPLM Project Office, FD24.

MSFC S&MA has the necessary authority to act upon or perform the following:

?? Plan and oversee NASA S&MA involvement in the MPLM Project Sustaining Engineering.

?? Monitor programmatic risk, mishaps and malfunctions.

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- ?? Review and make recommendations to the MSFC MPLM Project Office regarding safety requirements, quality, reliability, risk management, waivers, and deviations.
- ?? Analyze system design changes and monitor program test activities as necessary to verify these changes.



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## 2.0 APPLICABLE DOCUMENTS

Documents identified below may be used in implementing this plan.

- ?? NPG 7120.5A - NASA Program and Project Management Processes and Requirements
- ?? MPLM Project Plan, MSFC-PLAN-3064
- ?? MSFC Quality Manual \*

\* These documents are not included in the contract, however MSFC S&MA may use them for guidance.

## 3.0 ORGANIZATION AND RESPONSIBILITIES

The overall management of the MPLM Project is the responsibility of MSFC under direction of the ISS Vehicle Office. Additional project responsibilities are divided among the MPLM contractor, Alenia Spazio, the European Space Agency (ESA), the Johnson Space Center and the International Space Station Integrator, Boeing. The MSFC S&MA Director is responsible for the development and implementation of this plan.

### 3.1 S&MA Responsibilities

The S&MA Lead for the MPLM Project is responsible for the overall S&MA effort at MSFC, reporting directly to the MSFC S&MA Director and coordinating with the MSFC MPLM Project Manager. The S&MA Lead has direct access to all MPLM Project design and development information and staff. The MPLM S&MA Team will have access to any area necessary to assure safety and mission success. Management interfaces are shown in Figure 1. Solid lines represent direct reporting and dashed lines show lines of communication and coordination.

In addition, S&MA will assure life-cycle implementation of demonstrated, stable, capable, and controlled S&MA processes and that all members of the program team are aware of the S&MA

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goals and responsibilities. This will be accomplished through effective communication between the S&MA Lead and the other members of the program team.



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## 4.0 IMPLEMENTATION APPROACH

This section defines the primary MSFC S&MA tasks associated with the Sustaining Engineering effort for the MPLM. Additionally, where S&MA activities and responsibilities reside with organizations external to MSFC, such responsibilities are identified along with the responsible organizations.

### 4.1 Quality Assurance

#### 4.1.1 Objectives

Quality Assurance (QA) will provide guidance and define the requirements for oversight and assessment of the MPLM Project QA program implementation. MSFC QA oversight will provide accurate assessments of the quality assurance aspects of Alenia MPLM design, manufacturing, test, integration, processing and launch activities. The ultimate objective is to attain mission success by ensuring that MPLM meet the specified requirements.

##### 4.1.1.1 Tasks

As a minimum, the following tasks will be performed:

- ?? Participate in technical interchange meetings (TIM), project team meetings, and Milestone Reviews (SRR, PDR, CDR, DCR, AR, FRR, etc.).
- ?? Review and evaluate proposed changes to MSFC baselined project documentation.
- ?? Review and evaluate failure and discrepancy reports, analysis, and dispositions.
- ?? Review and evaluate verification data associated with engineering changes.
- ?? Develop and coordinate government agency representation and provide oversight of activities.
- ?? Provide input to project metrics activities.
- ?? Perform inspections (if in-house hardware)
- ?? Support SQA (if in-house hardware)

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?? Support audits and Acceptance Reviews

#### **4.1.1.2 Deliverables**

The following deliverables will be produced from the above tasks:

- ?? TIM and team meeting reports including actions, decisions, and status.
- ?? Assessment report of proposed documentation revisions and recommendation for approval or disapproval.
- ?? Assessment report of failure and discrepancy reports including recommendation for approval or disapproval.
- ?? Assessment report of verification data review conclusions and recommendations for approval or disapproval.

## **4.2 Reliability and Maintainability**

### **4.2.1 Objectives**

Reliability requirements during the sustaining engineering phase of the MPLM project are limited to evaluation of changes, including impact on existing reliability analyses, processing of ALERTS and support to processing of Problem Reports generated during module processing flows. ALERTs for the MPLM are the responsibility of Johnson Space Center, the European Space Agency and the MPLM contractor, Alenia Spazio. Alenia will address the European ALERTs equivalent and respond to GIDEP ALERTs (or Suspect Condition Action Notices) forwarded by JSC. MSFC has no role or responsibility for ALERTs processing for the MPLM.

#### **4.2.1.1 Tasks**

As a minimum, the following tasks will be performed:

- ?? Participate in TIMs, project team meetings, and Milestone Reviews (SRR, PDR, CDR, etc).
- ?? Review and evaluate proposed changes for R&M (Reliability and Maintainability) impact to flight hardware and MSFC baselined project documentation.

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- ?? Review and evaluate failure reports, analyses, and dispositions for impact related to R&M. Support MPLM Project in closure of Problem Reports.
- ?? Review and assess R&M testing results for compliance with requirements (as required by hardware modifications, if any)
- ?? Provide input to project R&M metrics.
- ?? Support Reliability Review Board for ISS Flight Element Hardware
- ?? Perform PRAs (Probability Risk Assessments) if deemed necessary by Project Office, if not in-house then contractor may perform.

#### **4.2.1.2 Deliverables**

The following deliverables will be produced from the above tasks:

- ?? R&M actions, decisions, and status resulting from TIMs and team meetings.
- ?? Assessment of proposed documentation revisions and recommendations for approval or disapproval.
- ?? Assessment of failure and discrepancy reports including recommendation for approval or disapproval based on impact to R&M. Problem Report closure data related to the MPLM FMEA (FMEA Worksheet Number and Failure Mode Criticality).

### **4.3 System Safety**

#### **4.3.1 Objective**

The System Safety function during the sustaining engineering phase of the MPLM project will include documentation of changes to integrated Hazard Analyses, as defined in the agreement with JSC Safety Review Panels, based on design changes to the MPLM or changes in the MPLM cargo manifest.

##### **4.3.1.1 Tasks**

As a minimum, the following tasks will be performed:

- ?? Update Reflight Safety Assessment, as required, prior to each flight.

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- ?? Participate in TIMs and project team meetings.
- ?? Support Product Development Team to assure safety requirements understood and incorporated in design.
- ?? Support Milestone Reviews (SRR, PDR, CDR, SRP, PAR, etc) and delta safety reviews (Flight and Ground, as appropriate) to document updates to safety analyses due to project changes.
- ?? Develop Safety Data Package/Hazard Analysis for In-house hardware (review SCDP/HA if not in-house hardware).
- ?? Support Safety Review Panels MSFC, JSC, KSC or Range as applicable.
- ?? Support Software Safety for project (Space Station elements only).
- ?? Evaluate project design changes for safety impacts.
- ?? Review Safety/Specification Verification Plans/procedure/closures.
- ?? Launch Mission Support as required.

#### **4.3.1.2 Deliverables**

The following deliverables will be produced from the above tasks:

- ?? Deltas to Integrated (GFE and non-GFE) MPLM Flight Hazards Analyses
- ?? Deltas to Integrated (GFE and non-GFE) MPLM Ground Hazards Analyses
- ?? Results from TIMs and other team meeting relative to issues, comments and recommendations related to safety.
- ?? Assessment of the Alenia provided updates to hazard analyses and safety data packages.
- ?? Assessment of the engineering change requests.

#### **4.4 Risk Management**

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The MPLM Project Risk Management system is the responsibility of the MSFC MPLM Project Manager. The risk management system will comply with NPG 7120.5A requirements.

#### **4.4.1 Objective**

S&MA will review the risk management process to ensure compliance with specified requirements and assess risk mitigation.

##### **4.4.1.1 Tasks**

As a minimum the following tasks will be performed:

- ?? Identify Safety and Mission Assurance risks as defined in the Project Plan
- ?? Ensure safety critical issues are assessed and closed.

##### **4.4.1.2 Deliverables**

- ?? S&MA Risk data
- ?? Closure data for identified S&MA risks

## **5.0 SCHEDULE AND MILESTONES**

Refer to the MSFC MPLM Project Milestone Schedule for program and S&MA milestones.



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## APPENDIX A

### MPLM Programmable Thermostat Quality Assurance Plan

#### 1.0 PURPOSE and SCOPE

##### 1.1. Purpose

The purpose of this appendix is to provide plans and instructions for quality assurance tasks and activities associated with in-house development and delivery of replacement thermostats for the International Space Station Multi-Purpose Logistics Modules

##### 1.2. Scope

The plans and instructions described in this appendix only apply to the equipment and processes associated with the MPLM Programmable Thermostat Assembly. Processes addressed include design, parts and materials procurement, receiving inspection, in-process inspection, qualification and acceptance testing, final inspection, and shipping. These tasks are in addition to the tasks described in the basic portion of this plan.

#### 2.0 Procurement Quality Assurance for Parts and Materials

The MPLM S&MA Lead will provide the quality assurance requirements and S&MA approval for purchase orders for the MPLM Programmable Thermostat Assembly in accordance with QS-QE-001. EEE parts shall meet the requirements of SSP 30312 and SSP 30423. Prior to assigning quality assurance requirements to EEE parts procurements, the S&MA Lead shall verify that the EEE Parts and Packaging Group (ED16) has approved the as-designed parts listing in writing.

Parts and materials traceability requirements shall be as specified by the Project Manager.

#### 3.0 Receiving Inspection

Receiving inspection/acceptance and assignment of parts tags for the MPLM Programmable Thermostat procurements shall be performed by the Cargo Assurance Department (QS30) Inspection

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Team in accordance with MPG 8730.1 and QS-QA-001. When hardware is fabricated by the on-site MSFC Fabrication Services contractor, the contractor will perform this function in compliance with their contract/procedures. Inspection requirements will be as specified in the purchase order.

#### **4.0 In-Process Inspection**

Verification by inspection during fabrication and assembly operations will be performed by the supplier. Inspection requirements will be established as specified in QS-QE-001 and QS-QA-018. Government source inspection for fabrication and assembly operations off site will be performed by MSFC/QS30. Oversight of the on-site MSFC Fabrication Services contractor in-process inspection will be provided by the QS30 Inspection Team.

#### **5.0 Qualification and Acceptance Testing**

The MPLM S&MA Lead and/or a designated representative will review, coordinate QS30 comments, and approve qualification and acceptance test plans and procedures.

Per QS-QA-003, the MSFC Inspection Team/Test Area Team shall perform the following tasks for in-house qualification and acceptance tests:

- a. Verify that the test article configuration is defined by approved drawings including release of floor engineering orders, that open items are not a constraint to test, and that the test and measuring equipment calibration is current.
- b. Assure that configuration and identity of test article is established prior to test and maintained throughout the test.
- c. Assure that tests are conducted as described by approved test procedures.
- d. Assure that changes to the test procedure are properly documented and approved per established requirements and that they do not violate the specification of the item under test, the Quality Plan, or the Project Plan.
- e. Monitor (start, significant sequences, end - less than 100% at other times) testing during data recording to verify that the applied test conditions (e.g., vibration, thermal) are within specified limits and the item under test is functioning

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within the required range when applicable. Indicate approval by stamping and dating the test procedure where required.

f. Assure that anomalies are documented and resolved in accordance with MPG 8730.3.

g. Assure that tests and inspections resulting from investigations of a failed condition are properly identified, recorded, and performed to the extent authorized.

The MPLM S&MA Lead will review qualification data to assure that the design is qualified for the intended use.

## **6.0 As-Built Configuration**

In accordance with QS-QA-027, upon completion of manufacturing and assembly operations, as-built end item summaries will be generated by the QS30 Inspection Team.

## **7.0 Final Inspection and Shipping**

Prior to shipment of the MPLM Programmable Thermostat Assembly from MSFC, the MPLM S&MA Lead shall verify that the acceptance data package meets project requirements, the as-built hardware configuration is documented and reserved EO's/FEO's are released, and the item is packaged properly. This verification will be accomplished via, FCA, PCA, Acceptance Review and/or Pre-Ship Review.

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## APPENDIX B

### ACCEPTANCE DATA PACKAGE TAILORED REQUIREMENTS, SSP30695A

The ADP is divided into 2 sections with one section for hardware and one section for software. For those Sections that aren't applicable to the subject Hardware or Software items, an N/A is recorded on this Index Page.

Hardware ADP Structure:

Section I Copy of Shipped/Delivery Document (DD250)  
FD24/QS30 or equivalent (Includes latest drawings)

Section II Historical Notes/Notes/Comments ED17

Section III Waivers/Deviations/Exceptions FD24

Section IV Unexplained Anomalies, (if any) FD24/ED17

Section V Shortages, (if any) FD24/ED17

Section VII Unplanned/Deferred Work, (if any)  
FD/ED17

Section VIII Identification - FCA/PCA  
QS30/ED17

Section IX Operating Time/Cycle, if applicable ED17

Section X Age Sensitive/Time Action Items, if any ED17/ED35

Section XI Nonstandard Calibration Data, if any ED17

Section XII Repair Limitation Data, if any ED17

Section XIII Pressure Vessel Data N/A

Section XIV Pyrotechnic Data N/A

Section XV Nonflight Hdwe/Temp Installations ED17

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Section XVI Cert's, including COC/MUA  
ED17/FD24/ED35

Section XVII MSDS (Material Safety Data Sheet): QS30  
(includes Reliability Data (MTBF/FMEA/CIL's) and Safety  
Data, (HR's/Assessments/Verif. Tracking Log)

Software ADP Structure:

Section I Copy of DD250 FD24/ED17

Section II Notes/Comments FD24/ED17

Section III Waivers/Deviations FD24/ED17

Section IV Unexplained Anomalies FD24/ED17

Section V Unplanned/Deferred Work FD24/ED17

Section VI Preplanned/Assigned Work FD24/ED17

Section VII Specifications Documents FD24/ED17

Section VIII Program Listing FD24/ED17

Section IX Version Description Document  
FD24/ED17

Section X User's Guide or Systems Operating Manual  
FD24/ED17

Section XI Certifications FD24/ED17